DEPARTMENT OF THE AIR FORCE
59TH MEDICAL WING (AETC)
JOINT BASE SAN ANTONIO - LACKLAND TEXAS

15 APR 2016

MEMORANDUM FOR SGST
ATTN: LT COL JACQUELINE KILLIAN

FROM: 59 MDW/SGVU

SUBJECT: Professional Presentation Approval

1. Your paper, entitled **The Impact of a Novel Biobehavioral Intervention on Physiologic State, Perceived Stress and Affect** presented at **Uniformed Services University Research Day May 25 2016** with MDWI 41-108, and has been assigned local file #**16160.**

2. Pertinent biographic information (name of author(s), title, etc.) has been entered into our computer file. Please advise us (by phone or mail) that your presentation was given. At that time, we will need the date (month, day and year) along with the location of your presentation. It is important to update this information so that we can provide quality support for you, your department, and the Medical Center commander. This information is used to document the scholarly activities of our professional staff and students, which is an essential component of Wilford Hall Ambulatory Surgical Center (WHASC) internship and residency programs.

3. Please know that if you are a Graduate Health Sciences Education student and your department has told you they cannot fund your publication, the 59th Clinical Research Division may pay for your basic journal publishing charges (to include costs for tables and black and white photos). We cannot pay for reprints. If you are 59 MDW staff member, we can forward your request for funds to the designated wing POC.

4. Congratulations, and thank you for your efforts and time. Your contributions are vital to the medical mission. We look forward to assisting you in your future publication/presentation efforts.

Linda Steel-Goodwin

LINDA STEEL-GOODWIN, Col, USAF, BSC
Director, Clinical Investigations & Research Support

PROCESSING OF PROFESSIONAL MEDICAL RESEARCH/TECHNICAL PUBLICATIONS/PRESENTATIONS

1. TO: CLINICAL RESEARCH	2. FROM: (Author's Name, Rank, Grade, Office Symbol)	3. GME/GHSE STUDENT:	4. PROTOCOL NUMBER:
	Jacqueline Killian, Lt Col, O5, 59MDW/ST	☐ YES ☒ NO	USU-TO-61-3105

5. PROTOCOL TITLE: (**NOTE:** For each new release of medical research or technical information as a publication/presentation, a new 59 MDW Form 3039 must be submitted for review and approval.)

A Biobehavioral Intervention's Impact on Physiologic State, Perceived Stress and Affect

6. TITLE OF MATERIAL TO BE PUBLISHED OR PRESENTED:

The Impact of a Novel Biobehavioral Intervention on Physiologic State, Perceived Stress and Affect

7. FUNDING RECEIVED FOR THIS STUDY? ☒ YES ☐ NO FUNDING SOURCE: Jonas Scholars Grant & USUHS

8. DO YOU NEED FUNDING SUPPORT FOR PUBLICATION PURPOSES: ☐ YES ☒ NO

9. IS THIS MATERIAL CLASSIFIED? ☐ YES ☒ NO

10. IS THIS MATERIAL SUBJECT TO ANY LEGAL RESTRICTIONS FOR PUBLICATION OR PRESENTATION THROUGH A COLLABORATIVE RESEARCH AND DEVELOPMENT AGREEMENT (CRADA), MATERIAL TRANSFER AGREEMENT (MTA), INTELLECTUAL PROPERTY RIGHTS AGREEMENT ETC.?
☐ YES ☒ NO **NOTE:** If the answer is YES then attach a copy of the Agreement to the Publications/Presentations Request Form.

11. MATERIAL IS FOR: ☒ DOMESTIC RELEASE ☐ FOREIGN RELEASE
CHECK APPROPRIATE BOX OR BOXES FOR APPROVAL WITH THIS REQUEST. ATTACH COPY OF MATERIAL TO BE PUBLISHED/PRESENTED.

☐ 11a. PUBLICATION/JOURNAL (List intended publication/journal.)

☐ 11b. PUBLISHED ABSTRACT (List intended journal.)

☒ 11c. POSTER (To be demonstrated at meeting: name of meeting, city, state, and date of meeting.)
Uniformed Services University Research Day May 25, 2016

☐ 11d. PLATFORM PRESENTATION (At civilian institutions: name of meeting, state, and date of meting.)

☐ 11e. OTHER (Describe: name of meeting, city, state, and date of meeting.)

12. EXPECTED DATE WHEN YOU WILL NEED THE CRD TO SUBMIT YOUR CLEARED PRESENTATION/PUBLICATION TO DTIC
NOTE: All publications/presentations are required to be placed in the Defense Technical Information Center (DTIC).

DATE	
April 06, 2016	

13. 59 MDW PRIMARY POINT OF CONTACT (Last Name, First Name, M.I., email)	14. DUTY PHONE/PAGER NUMBER
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15. AUTHORSHIP AND CO-AUTHOR(S) List in the order they will appear in the manuscript.

LAST NAME, FIRST NAME AND M.I.	GRADE/RANK	SQUADRON/GROUP/OFFICE SYMBOL	INSTITUTION (If not 59 MDW)
a. Primary/Corresponding Author Jacqueline Killian	O-5/Lt Col	59 MDW/ST	
b.			
c.			
d.			
e.			
f.			

I CERTIFY ANY HUMAN OR ANIMAL RESEARCH RELATED STUDIES WERE APPROVED AND PERFORMED IN STRICT ACCORDANCE WITH 32 CFR 219, AFMAN 40-401_IP, AND 59 MDWI 41-108. I HAVE READ THE FINAL VERSION OF THE ATTACHED MATERIAL AND CERTIFY THAT IT IS AN ACCURATE MANUSCRIPT FOR PUBLICATION AND/OR PRESENTATION.

16. AUTHOR'S PRINTED NAME, RANK, GRADE	17. AUTHOR'S SIGNATURE	18. DATE
Jacqueline Killian Lt Col/ O5	KILLIAN.JACQUELINE.M.1050091976	April 06, 2016
19. APPROVING AUTHORITY'S PRINTED NAME, RANK, TITLE	**20. APPROVING AUTHORITY'S SIGNATURE**	**21. DATE**
Brenda J. Morgan, Col, USAF, NC	MORGAN.BRENDA.J.1135106085	April 06, 2016

PROCESSING OF PROFESSIONAL MEDICAL RESEARCH/TECHNICAL PUBLICATIONS/PRESENTATIONS

1st ENDORSEMENT (59 MDW/SGVU Use Only)

TO: Clinical Research Division 59 MDW/CRD Contact 292-7141 for email instructions.	22. DATE RECEIVED 4/7/2016	23. ASSIGNED PROCESSING REQUEST FILE NUMBER 16160
24. DATE REVIEWED 7 Apr 2016		25. DATE FORWARDED TO 502 ISG/JAC

26. AUTHOR CONTACTED FOR RECOMMENDED OR NECESSARY CHANGES: ☒ NO ☐ YES If yes, give date. _____ ☐ N/A

27. COMMENTS ☒ APPROVED ☐ DISAPPROVED

The poster is approved.

28. PRINTED NAME, RANK/GRADE, TITLE OF REVIEWER	29. REVIEWER SIGNATURE	30. DATE
Rocky Calcote, PhD, Clinical Research Administrator	CALCOTE.ROCKY.D.1178245844	

2nd ENDORSEMENT (502 ISG/JAC Use Only)

31. DATE RECEIVED	32. DATE FORWARDED TO 59 MDW/PA

33. COMMENTS ☐ APPROVED (In compliance with security and policy review directives.) ☐ DISAPPROVED

34. PRINTED NAME, RANK/GRADE, TITLE OF REVIEWER	35. REVIEWER SIGNATURE	36. DATE

3rd ENDORSEMENT (59 MDW/PA Use Only)

37. DATE RECEIVED April 15, 2016	38. DATE FORWARDED TO 59 MDW/SGVU April 15, 2016

39. COMMENTS ☒ APPROVED (In compliance with security and policy review directives.) ☐ DISAPPROVED

40. PRINTED NAME, RANK/GRADE, TITLE OF REVIEWER	41. REVIEWER SIGNATURE	42. DATE
Michael Ellis, SSgt, 59 MDW PA	ELLIS.MICHAEL.ALLEN.10465568 40	April 15, 2016

4th ENDORSEMENT (59 MDW/SGVU Use Only)

43. DATE RECEIVED	44. SENIOR AUTHOR NOTIFIED BY PHONE OF APPROVAL OR DISAPPROVAL ☐ YES ☐ NO ☐ COULD NOT BE REACHED ☐ LEFT MESSAGE

45. COMMENTS ☐ APPROVED ☐ DISAPPROVED

46. PRINTED NAME, RANK/GRADE, TITLE OF REVIEWER	47. REVIEWER SIGNATURE	48. DATE

The Impact of a Novel Biobehavioral Intervention on Physiologic State, Perceived Stress and Affect

Lt Col Jacqueline Killian, 59 MDW/ST, JBSA-Lackland

*Daniel K. Inouye Graduate School Of Nursing, Uniformed Services University of the Health Sciences, Bethesda, MD

MILITARY SIGNIFICANCE

As a result of over 15 years of war, members of the military services have experienced unprecedented consequences related to the stresses of serving during this time .[1-3] Early detection, characterization, and treatment of stress-related disorders is one of the highest priorities for the armed forces and military medical research, as a means of force health protection. One complementary intervention, laughter yoga (LY), has yet to be investigated in a military population but is a promising treatment for stress related disorders.[1,2]

BACKGROUND

- Significant health problems associated with chronic stress include: heart disease, cancer, asthma, and gastrointestinal disturbances.[3]
- Physiologic response to stress involves a cascade of complex internal multisystem actions.
- Cardiovascular and respiratory systems are complementary and reciprocal, providing continual modulation to maintain allostasis.
- Individuals resilient to stress have been shown to return to allostasis more quickly; activating their sympathetic nervous system (SNS) to respond more efficiently while mitigating the damaging effects of allostatic load.[4]
- Heart rate variability (HRV) is a means of measuring autonomic nervous system response.[5]
  - variability = SNS activation potentially caused by acute or chronic stress
  - variability = vagal tone/ parasympathetic nervous system activation (PNS).[6]
- Respiratory system response to stress = respiratory rate and tidal volume
- Slower respiratory rate with larger tidal volumes stimulate the vagus nerve, which activates the PNS
- LY involves physical exercise and breath work that stimulates the vagus impacting sympathetic parasympathetic balance and increases oxygen which is known to aid in healing and improving energy levels to aid in stress management.

PURPOSE

The search for innovative, non-invasive and cost-effective means of mitigating the effects of stress is the basis of this pilot study.

Purpose: To explore the use of LY as a method to mitigate the physiologic effects of stress and begin to identify the protective factors associated with resilience in a military student population.

METHODS

Design: Quasi-experimental pre/post-test wait-listed control group

	T 1	Wk 1	Wk 2	T 2	Wk 3	Wk 4	T 3
	Base-line			Mid-Study			End of Study
Experimental (E) Group (n = 20)	X	LY	LY	X	___	___	X
Wait-listed Control (WLC) Group (n =21)	X	___	___	X	LY	LY	X

Table 1. Experimental Design. X denotes observation / measurement collection

Disclaimer: The opinions expressed herein are those of the authors, and are not necessarily representative of those of the Uniformed Services University of the Health Sciences (USUHS), the Department of Defense (DOD), or the United States Army, Navy, or Air Force.

METHODS

Sample: 41 volunteer military graduate students age 23-52 (*M* = 31) randomly assigned to E and WLC groups

Physiologic data acquisition devices:

- emWave2 device (HeartMath LLC)[8] uses photoplethysmography to obtain pulse waveform from the microvascular tissue bed via sensor attached to ear lobe with an ear clip (Fig.1)
- Handheld Peak Flow Meter (Mabisdmi.com)[9] measures the amount of air expelled from the the lungs following deep inhalation (Fig.2)

Figure 1. emWave2 device

Figure 2. Mabis Handheld Peak Flow Meter

Physiologic Measures:

- Heart Rate Variability & Peak Expiratory Flow Rate
  - 10 minutes cardiac inter-beat interval (IBI) data
  - 3 Peak Flows were collected:
    - at baseline and following the 2 week intervention period
    - before and after each LY session

Figure 3.

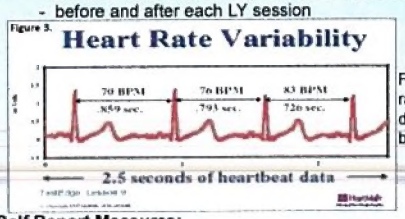

Figure 3. Illustration of heart rate variability defined as the difference in milliseconds between heart

Self Report Measures:

- Perceived Stress Scale
- PHQ-8 (measure of depressive symptoms)
- PANAS (Positive Affect Negative Affect Scale)
- CD-RISC (Connor Davidson Resilience Scale
- General Health Scale (SF-36)
- Open-ended questions regarding the laughter yoga experience

DATA ANALYSIS

- Independent sample and paired *t* tests were performed for between groups and within group comparison for physiologic measures along with Friedman's two-way analysis of variance by ranks with pairwise comparison with Bonferonni correction for multiple comparisons over six time points.
- Mann-Whitney U were performed for between group comparison and Wilcoxon Signed Rank for within groups comparison of change scores calculated from self-report scores
- Independent thematic analysis of verbal responses to open ended questions (accomplished by five research team members

RESULTS

- Independent samples *t* test results indicate no significant difference at baseline nor post intervention for between groups comparison.
- Results of paired sample *t* test are reported in Table 2.
- Repeated measures analysis of variance conducted to determine if any significant differences occurred over six time points. Results of Friedman test indicated that measures of STD HR and PEFR were significantly different as follows:
- STD HR (X^2 (5, n = 32) = 14.05, p = .015). Inspection of median values showed decrease from baseline (*Md* = 4.99) to T2 (*Md* = 4.15) which appeared to recover by post-intervention (*Md* = 4.89)
- PEFR (X^2 (5, n = 41) = 184.26, p <.001). Inspection of median values showed decrease from baseline (*Md* = 463.33) to T2 (*Md* = 317.16) which increased by post-intervention (*Md* = 480)

RESULTS

Results of Paired Sample *t* Test Comparing Pre and Post Intervention Physiologic Measures of Heart Rate Variability (HRV) and Peak Expiratory Flow Rate (PEFR) for Experimental (Ex) and Wait-listed Control (WLC) Groups

Variable	Group	*T* Statistic	*Df*	*p* value
STD RR	Ex	3.111	19	.006*
	WLC	1.012	17	.327
RMSSD	Ex	2.494	19	.023*
	WLC	1.998	17	.063
HF	Ex	2.378	19	.029*
	WLC	1.32	17	.206
PEFR	Ex	-4.442	20	< .001*
	WLC	-1.046	21	.308

Table 2. Statistically significant decreases for STD RR (Standard deviation of the R to R interval), RMSSD (Root mean square of successive differences between inter-beat intervals) and HF (High Frequency) HRV measures and statistically significant increase in PEFR. Note: * indicates statistical significance, set at p < .05.

Variable	GP	N	Md	Mann Whitney U	Test Statistic (Z)	Effect Size (r)
Positive Affect	Ex	20	125.5	147.5	-1.633	.26
	WLC	21	2			
SF36 Role	Ex	20	8.33	147.5	-1.633	.26
Emotional	WLC	21	-8.34			
SF 36 Mental	Ex	20	5	320.5	2.91	.45
Health	WLC	21	0			
SF 36 Physical	Ex	20	-2.7	100	-2.695	.42
Component	WLC	21	2.14			
Summary						

Table 3. Results of between groups comparison Mann Whitney *U* analyses. Note: N- number of participants in each group; z = z score; * indicates statistical significance, $p \leq .05$; r = measure of effect size, sung Cohen (1988) criteria of .1 = small effect; .3= medium effect and .5 = large effect

Variable	N	Test Statistic (Z)	P (<.05)	Observed Median	Effect Size (r)	% Score Change Decrease/Increase	
PSS	41	.091	.928	0	.01	45%	46%
PA	41	4.369	<.005*	11	.48	29%	66%
NA	41	-1.789	.074	-1	.01	76%	17%
PHQ8	41	-1.154	.248	0	.18	46%	14%
SF36 Role Physical	41	1.994	.046*	0	.22	17%	32%
SF 36 Gen Health	41	2.137	.033*	5	.24	16%	60%
SF 36 Mental Health	41	5.484	<.005*	12.9	.61	2%	98%
Resilience	41	2.158	.031*	2	.24	27%	66%

Table 4. Results of Wilcoxon Singed Rank analyses. N = number of participants in each group; z = z score; * indicates significant finding, $p \leq .05$; r = measure of effect size, sung Cohen (1988) criteria of .1 = small effect; .3= medium effect and .5 = large effect

- Thematic analysis of verbal responses to open ended questions resulted in four main themes regarding how laughter yoga participation affected their mood, sensory state, relationships and lifestyle choices.

IMPLICATIONS

Results of this pilot study contribute to the growing body of evidence regarding the physiologic and psychological impact of LY participation. Changes observed in HRV measures and PEFR suggest that participation in LY may provide an alternative aerobic activity that can assist in reducing stress while improving respiratory status. Whereas increases in positive affect, mental health and resilience scores, as well as participant open responses indicate further investigation is needed to determine whether continued participation would result in progressive changes that could promote resilience in military members.

Acknowledgements: This research was funded by the Jonas Center for Nursing and Veterans Healthcare and the Uniformed Services University of the Health Sciences (USUHS). Support and resources were also provided by the Traumatic Injury Research Program (TIRP), Military & Emergency Medicine Department of USUHS. Dr. Penny Pierce, Dr. Catherine Ling, Dr. Paul Rapp, Dr. David Keyser, Dr. Dominic Nathan and Dr. Cora Olsen are acknowledged for their guidance, patience, support and encouragement throughout the research process.

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- Individuals resilient to stress have been shown to return to allostasis more quickly; activateing their sympathetic nervous system to respond more efficiently while mitigating the damaging effects of allostatic load.[4]
- Heart rate variability (HRV) is a means of measuring autonomic nervous system response.[5] Decreased variability signifies activation of the sympathetic nervous system potentially caused by acute or chronic stress
- Increased variability denotes increased vagal tone and activation of the parasympathetic nervous system.[6]
- The respiratory system response to stress is characterized by increased respiratory rate and decreased tidal volume, whereas slower respiratory rate with larger tidal volumes stimulate the vagus nerve, which activates the parasympathetic nervous system.[7]
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